CLAIMS

1. A current supply circuit comprising:

a voltage doubler rectifying circuit (22) connected to an AC 200 V system power supply (1); and

a polyphase inverter circuit (42) including series connection of two switching elements having a breakdown voltage of 1200 V for each phase, and outputting an AC current of each phase from a node of said series connection.

2. The current supply circuit according to claim 1, wherein

said switching element is an IGBT element.

3. The current supply circuit according to claim 2, wherein

said voltage doubler rectifying circuit and said polyphase inverter circuit are modularized.

4. A polyphase drive circuit comprising:

the current supply circuit according to claim 2 or 3; and

a polyphase motor for 400 V (M2) supplied with current from said polyphase inverter circuit.

5. A method of designing a current supply circuit (22, 32, 42) applied with an AC voltage of a predetermined effective value voltage to output a polyphase AC current to a polyphase load (M2) of a predetermined rated power,

said current supply circuit comprising a polyphase inverter circuit (42), said

polyphase inverter circuit including series connection of two switching elements for each phase, and outputting said AC current of each phase from a node of said series connection, and

said method comprising the steps of:

(a) setting a current value as a rated current value of said polyphase inverter circuit, said current value being obtained by dividing said rated power of said polyphase load by a voltage value being twice said effective value voltage (S21); and

(b) selecting said switching element having a second breakdown voltage based on said rated current value, said second breakdown voltage being twice a first breakdown voltage required of said switching element when a DC voltage obtained by performing full-wave rectification on said AC voltage is input to said polyphase inverter circuit (S25).

6. The method of designing a current supply circuit according to claim 5, wherein

said AC voltage of said predetermined effective value voltage is a single phase, and

said current supply circuit further comprises a voltage doubler rectifying circuit (22) performing voltage doubler rectification on said AC voltage of said predetermined effective value voltage to output a rectified voltage to said polyphase inverter circuit (42).

7. The method of designing a current supply circuit according to claim 5, wherein

in said step (b), as a switching frequency (fsw) of said inverter increases, said switching element is selected in a range with low turn-on losses (Esw(on)) in said rated

current value.

8. The method of designing a current supply circuit according to claim 7, wherein

said step (b) further comprises the steps of:

(b-1) setting turn-on losses (Esw(on) = Esw / 2) based on dynamic losses (Psw) required in regard to said switching element and said switching frequency (fsw) of said inverter; and

(b-2) selecting said switching element having said second breakdown voltage, and producing almost the same turn-on losses as said turn-on losses in said rated current value set in said step (b-1).

9. The method of designing a current supply circuit according to claim 6, wherein

in said step (b), as a switching frequency (fsw) of said inverter increases, said switching element is selected in a range with low turn-on losses (Esw(on)) in said rated current value.

10. The method of designing a current supply circuit according to claim 9, wherein

said step (b) further comprises the steps of:

(b-1) setting turn-on losses (Esw(on) = Esw / 2) based on dynamic losses (Psw) required in regard to said switching element and said switching frequency (fsw) of said inverter; and

(b-2) selecting said switching element that has said second breakdown

voltage, and produces almost the same turn-on losses as said turn-on losses in said rated current value set in said step (b-1).

11. The method of designing a current supply circuit according to claim 5, wherein

said switching element is an IGBT element, and

in said step (b),

an increment (ΔEsw) of turn-on losses in rated current value of said IGBT element having said second breakdown voltage with reference to turn-on losses (EL) in rated current value of said IGBT element having said first breakdown voltage is defined as a divisor,

the product of a value (VL −ΔVce) being obtained by subtracting an increment (ΔVce) of a saturation voltage of said IGBT element having said second breakdown voltage with reference to a saturation voltage (VL) of said IGBT element having said first breakdown voltage from said saturation voltage, a maximum value (Icp) of an output current of said inverter in terms of sinusoidal wave, and (π / 16), is defined as a dividend, and

said IGBT element having said second breakdown voltage is selected in an area with a lower switching frequency (fsw) of said inverter than the result obtained by dividing said dividend by said divisor.

12. The method of designing a current supply circuit according to 6, wherein

said switching element is an IGBT element, and

in said step (b),

an increment (ΔEsw), multiplied by a factor of (2 / π), of turn-on losses in

rated current value of said IGBT element having said second breakdown voltage with reference to turn-on losses (EL) in rated current value of said IGBT element having said first breakdown voltage is defined as a divisor,

a value is defined as a dividend, said value $(Pd + (VL - \Delta Vce) \cdot Icp / 8)$ being obtained by adding losses (Pd) for one diode included in said voltage doubler rectifying circuit (22) to the product of a first value, a second value, and a third value, said first value $(VL - \Delta Vce)$ being obtained by subtracting an increment (ΔVce) of a saturation voltage of said IGBT element having said second breakdown voltage with reference to a saturation voltage (VL) of said IGBT element having said first breakdown voltage from said saturation voltage, said second value (Icp) being a maximum value of an output current of said inverter in terms of sinusoidal wave, and said third value being (1 / 8), and

said IGBT element having said second breakdown voltage is selected in an area with a lower switching frequency (fsw) of said inverter than the result obtained by dividing said dividend by said divisor.

13. The method of designing a current supply circuit according to claim 11, wherein

said inverter has said switching frequency (fsw) set to 7 kHz or less.

14. The method of designing a current supply circuit according to claim 5, wherein

said predetermined effective value voltage is 200 V, and said first breakdown voltage is 600 V.

15. The method of designing a current supply circuit according to any one of

claims 5 to 14, wherein

said switching element is an IGBT element.